

Northeast Florida Regional Council
Military Installation Readiness Review



Playing the Long Ball: **A Preparation Strategy for Future Erosion Impacts**

APRIL 2026



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1 Introduction

Military readiness along Northeast Florida's coast is increasingly shaped by the evolving threat of sea level rise, tidal amplification, and storm surge. Installations including Naval Station Mayport, Blount Island, and Jacksonville Air Force Station together with mission-critical support facilities along the St. Johns River are situated within low-lying coastal and estuarine environments already experiencing higher nuisance flooding frequencies and expanding flood extents during coastal storms. Shoreline conditions vary from natural marsh edges to riprap and hardened segments, reflecting decades of localized protection strategies rather than a system-wide approach. However, continuous armoring of riverine shorelines is neither practical nor environmentally sustainable, as it can accelerate erosion, degrade wetlands, and reduce the natural flood attenuation these habitats provide. Oceanfront areas benefit from existing inlet jetty stabilization and periodic beach renourishment, yet these measures do not address compound flooding risks propagating through the river system. This white paper evaluates projected flooding across multiple planning horizons, identifies critical failure points affecting installation access, utilities, and operational continuity, and outlines targeted mitigation pathways that balance mission resilience with ecological stewardship.

1.1 Importance of Beach and Inland Shorelines

Shorelines at coastal military installations in northeast Florida provide mission-critical protective functions that extend well beyond erosion control: they form the first line of defense against overtopping from storm surge and elevated astronomical tides, dissipate wave energy before it reaches bulkheads and facility pads, and reduce the likelihood that floodwaters undermine or damage road, bridge, and causeway approaches that enable personnel, fuel, munitions, and logistics access during blue-sky conditions and post-storm recovery (Office of the Under Secretary of Defense, 2019; GAO, 2020).

For Naval Station Mayport, an installation adjacent to a busy harbor that accommodates dozens of ships, shoreline integrity helps sustain pier-side and airfield-adjacent operations and protects waterfront utilities, housing and access corridors that support fleet activity. Preventing recurrent tidal flooding and storm-surge-driven access disruptions at Naval Station Mayport is essential to maintaining the installation's ship maintenance and operational readiness functions (Center for Climate and Security, 2018; Union of Concerned Scientists, 2016). Waterfront facilities support intermediate-level maintenance activities (e.g., repair, testing, calibration) conducted by tenant commands such as Southeast Regional Maintenance Center, where vessels rely on predictable pier access, staging areas, utilities, and transportation corridors to execute scheduled and emergent repairs. Even shallow or short-duration flooding can delay material deliveries, restrict personnel movement, impair electrical and mechanical systems, and reduce safe use of waterfront infrastructure, effects that cascade into extended maintenance availabilities and decreased fleet readiness. Ensuring shoreline stability and reliable installation access therefore directly supports operational continuity by minimizing repair delays, protecting critical support infrastructure, and preserving the Navy's ability to generate and sustain deployable forces from the Mayport homeport.

Along the St. Johns River, Blount Island's shoreline is integral to the prepositioning mission, protecting the pier and adjacent staging/maintenance areas used to sustain and load combat-ready equipment and supplies for global deployments while also serving as part of a broader wetland–



estuarine buffer that receives drainage, attenuates flood peaks, and helps maintain restricted-area separation from surrounding development (U.S. Army Corps of Engineers, 2014).

At Naval Air Station Jacksonville, shoreline stability along the St. Johns River helps safeguard critical infrastructure that enables aviation readiness and base operations. The installation provides facilities and support for the operation and maintenance of naval aircraft and weapons systems, and mission-support activities include fuel storage and distribution networks, aircraft maintenance facilities, utilities, and transportation corridors essential to sustaining operations (EPA, 2024). Flooding, bank erosion, or storm-driven inundation could disrupt access routes, degrade electrical and mechanical systems, and affect fuel and maintenance functions that support flight operations. Maintaining resilient shoreline conditions therefore reduces operational risk by protecting infrastructure that underpins aviation, training, and logistics while helping preserve installation functionality during coastal and compound flood events.

1.2 Feasibility for Coastal Hazard Mitigation

Evaluating the feasibility of shoreline hazard mitigation at Northeast Florida military installations requires balancing mission protection with environmental stewardship and practical constraints. Shorelines adjacent to Naval Station Mayport, Blount Island Command, and Naval Air Station Jacksonville include approximately 20 miles of tidally influenced shoreline along the St. Johns River, more than a mile of ocean-facing beach, and additional canal and wetland edges. As sea levels continue to rise, higher tides and storm surge are placing increasing pressure on these shorelines. In several locations, past protective measures are showing signs of wear e.g., riprap has shifted, some seawalls and docks sit low relative to current water levels, and older revetments may no longer provide the level of protection originally intended.

Ownership of these shorelines is predominantly federal, with additional segments managed by the City of Jacksonville and a limited number of private marinas. This ownership pattern improves feasibility of implementing adaptation actions from a coordination perspective, as coastal hazard mitigation is not constrained by numerous private property owners, but it also concentrates responsibility for implementation and funding within federal agencies, with limited opportunity to rely on external funding partners. While the extent of shoreline exposure underscores the importance of resilience, the length involved makes continuous shoreline armoring impractical and cost-prohibitive, and widespread hardening would negatively affect adjacent wetlands by disrupting hydrology, increasing wave reflection, and reducing flood storage capacity.

Feasibility is therefore highest where coastal hazard mitigation can be targeted rather than uniform. Much of the shoreline remains natural or lightly stabilized, meaning resilience strategies should focus on elevating or protecting specific infrastructure segments that are critical to operations rather than attempting to keep all shoreline areas dry. In some areas, land use may need to be adapted to accommodate periodic flooding, while in others, selective protection may be justified. Importantly, discrete flow paths along canals, low-lying shoreline segments, and access corridors often govern the extent of inland inundation; addressing these specific entry points through localized barriers, grade adjustments, or nature-based features can reduce flood impacts without extensive shoreline armoring.



2 Current State of Shoreline Vulnerability

2.1 Projected Shoreline Inundation

Recent assessments have concluded that coastal military installations face growing exposure to sea level rise, storm surge, and recurrent flooding that may impair mission readiness (GAO, 2020; Center for Climate and Security, 2018). Consistent with these findings, the Northeast Florida Military Installation Resilience Review (2026) identified that inundation of shorelines was a high risk to mission along Naval Station Mayport and Blount Island under a range of coastal flooding scenarios. Scenario-based analyses indicate that by approximately 2050, inundation could affect roughly 25 percent of Naval Station Mayport by area, with flooding first impacting shoreline-adjacent infrastructure and propagating inland to affect stormwater systems, command and control functions, logistics areas, wharfs, transportation access, and energy infrastructure (Union of Concerned Scientists, 2016; Center for Climate and Security, 2018). Under longer-term scenarios, inundation is projected to extend to a broader set of facilities, including personnel support, public works, wastewater management, off-site electrical substations, and refueling operations (Center for Climate and Security, 2018). At Naval Air Station Jacksonville, federal assessments similarly identify low-lying shoreline areas, including portions of the Superfund site, as vulnerable to inundation under sea level rise and surge conditions (EPA, 2025).

Observed storm events provide additional context for these projections. Hurricanes Ophelia (2005), Matthew (2016), Irma (2017), Ian (2022), and Nicole (2022) produced documented shoreline overtopping of multiple feet along low-lying reaches of the St. Johns River, demonstrating how surge and elevated tides can rapidly exceed existing shoreline elevations and drive flooding inland. These historical events underscore that while extreme storms are episodic, their impacts are amplified as rising sea levels elevate baseline water conditions.

Across studies, a consistent finding is that the frequency and duration of tidal inundation increase as mean sea level rises, even in the absence of major storms. As baseline water levels increase along both the Atlantic coast and tidally influenced reaches of the St. Johns River, low-lying shoreline areas experience more frequent flooding, placing sustained stress on shoreline edges, dunes, bulkheads, marsh platforms, and other protective features (Hall et al., 2016). Over time, these conditions increase susceptibility to erosion and reduce the capacity of shorelines to attenuate storm-driven water levels.

Similar patterns are evident at other shoreline-adjacent installations along the lower St. Johns River. At Blount Island and Naval Air Station Jacksonville, inundation mapping shows that incremental increases in water level initially affect shoreline roads, access routes, and low-lying developed areas, with more extensive flooding occurring only at higher thresholds (NOAA, 2025). In contrast, inland installations such as Whitehouse Landing Field and Camp Blanding are not directly exposed to coastal inundation, highlighting that vulnerability along the St. Johns River emerges first at the land–water interface, regardless of facility type.



Based on these findings, the figures that follow focus on identifying specific shoreline locations and connected flow paths where overtopping and inland inundation are most likely to initiate. Rather than evaluating inundation extent in aggregate, the figures show that flood vulnerability across Northeast Florida military installations is driven by discrete low-elevation shoreline segments and their connectivity to internal drainage networks, road crossings, and hardened shorelines. Inundation consistently begins where shoreline elevations fall below projected tidal thresholds and expands inland along these pathways, allowing critical failure points to be evaluated across near-, mid-, and long-term planning horizons and prioritized for targeted mitigation.

At Naval Station Mayport (Figure 2-1), early inundation is concentrated along the canal system paralleling Perimeter Road, which provides a direct pathway for tidal water to move inland under moderate sea level rise scenarios. By mid-century conditions, inundation extends through culverts beneath Mayport Road, increasing the risk of interior flooding and, under higher water levels, contributing to eventual encroachment toward the airfield. Shorelines protecting facilities north of Access Road show increasing flood vulnerability as protective elevations are exceeded, while armored shoreline segments along Massey Avenue and Macon Street experience

overtopping at higher thresholds, indicating diminishing effectiveness of existing hardening. Along the ocean-facing edge, inundation mapping shows increasing exposure along A1A, with the south inlet jetty becoming increasingly stressed and potentially compromised by late-century conditions (e.g., ~2080), affecting shoreline stability near the inlet.

Figure 2-1. Potential Shoreline Inundation near NAS Mayport

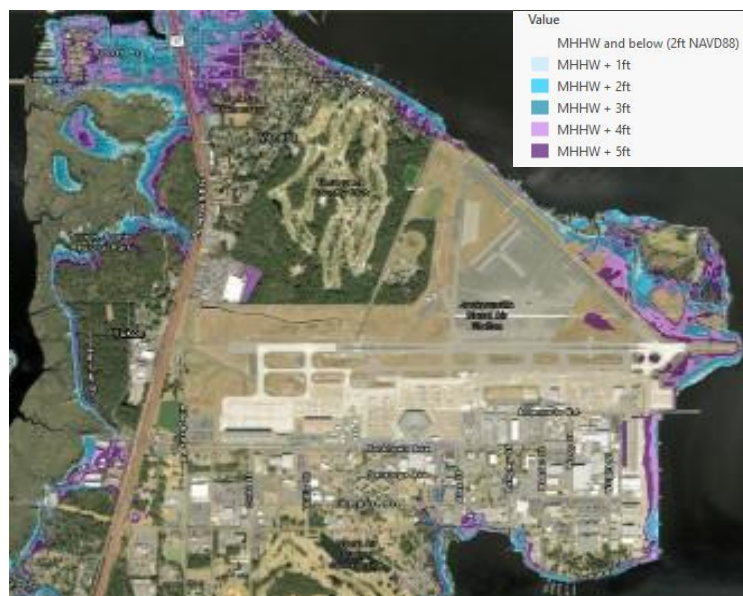


Figure 2-2. Shoreline Inundation at Blount Island

At Blount Island Command (Figure 2-2), inundation initiates along the northwest armored shoreline and lower dock elevations, where existing protection is overtopped early relative to interior areas. Flooding progresses inland through the central canal corridor, which acts as a primary conduit for water movement across the island. The figures also highlight growing vulnerability at the two bridge crossings that provide access to Blount Island, where reduced clearance and increased water levels may impair access or increase structural stress under far-term scenarios. These access constraints represent a critical operational vulnerability, as they

govern both routine logistics and emergency response capability.

At Naval Air Station Jacksonville (Figure 2-3), inundation is more localized but still operationally relevant. The figures indicate overtopping along the southeastern seawall and exposure along the marina shoreline near Bluff Road, where low elevations allow tidal water to affect shoreline-adjacent infrastructure. In addition, the Roosevelt Boulevard bridge emerges as a

Figure 2-3. Shoreline Inundation near Naval Air Station Jacksonville

potential vulnerability, where increased scour and hydraulic stress associated with shoreline loss could affect access reliability to the installation over time.

Across all installations, the figures demonstrate that incremental increases in water level result in nonlinear expansion of inundation once key elevation thresholds are exceeded, particularly where shoreline overtopping connects directly to internal drainage networks or access corridors. These results reinforce that mitigation feasibility and effectiveness are greatest when focused on specific shoreline segments,



canals, road crossings, and access points that govern inland flooding extent. Accordingly, the findings support a targeted mitigation strategy aligned with near-, mid-, and long-term planning horizons, prioritizing interventions at the most consequential and actionable failure points rather than continuous shoreline armoring.

2.2 Existing Shoreline Conditions

The potential for shoreline inundation is based on topographic and projected water surface elevations. However, shoreline vulnerability is governed by a broad set of physical and operational factors beyond ground elevation alone. Shoreline type, including natural marsh, beach systems, riprap, bulkheads, and hardened waterfront infrastructure, strongly influences exposure by affecting wave attenuation, erosion resistance, and the likelihood of structural failure during surge events. The presence, condition, and design life of existing armoring are equally important, as aging or undersized protection can accelerate scour, promote flanking, and increase maintenance burdens. Additional pressures such as chronic erosion, vessel wake, channel deepening, altered sediment transport, subsidence, and compound flooding from coincident rainfall and tidal forcing can further destabilize shoreline edges over time.

Vulnerability should also be evaluated in terms of adaptive capacity: the availability of landward space for shoreline migration or nature-based features, environmental permitting constraints associated with wetlands and essential habitats, constructability, lifecycle cost relative to shoreline length, and the criticality of adjacent infrastructure supporting installation access, utilities, staging areas, and waterfront operations. Together, these factors underscore the need for a systems-based shoreline assessment that integrates current conditions, infrastructure dependency, and feasible mitigation pathways when prioritizing resilience investments.

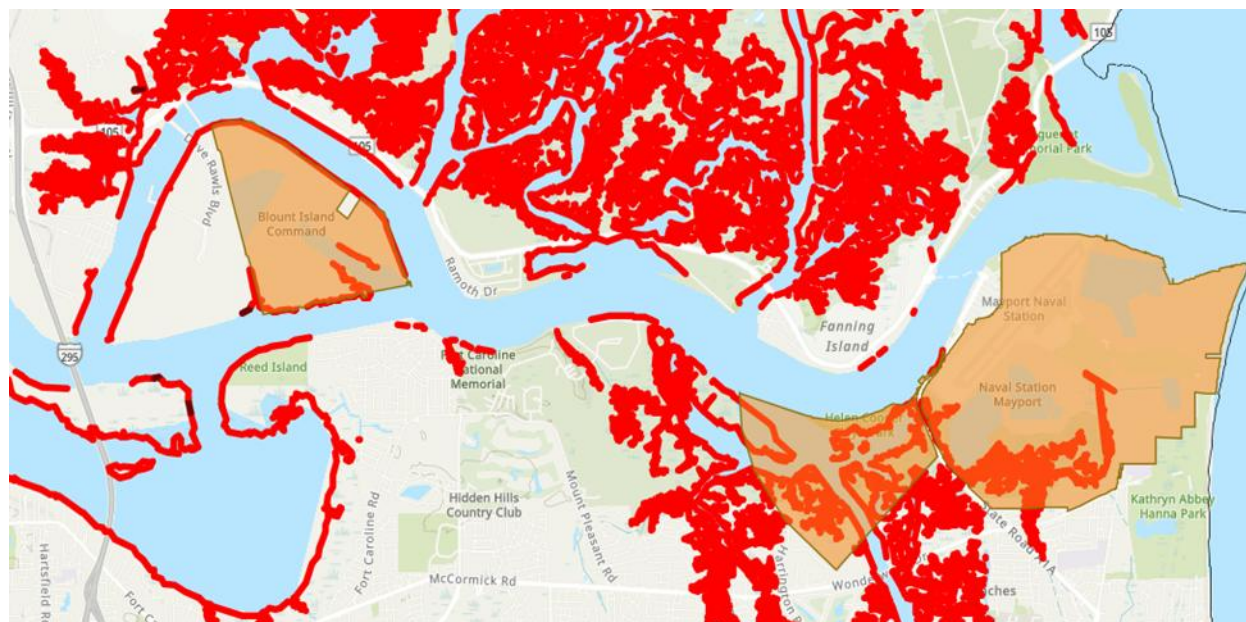
2.2.1 Shoreline Type

Shoreline type influences how energy from waves, tides, and vessel traffic is absorbed or reflected, how shorelines respond to repeated flooding and elevated water levels, and the range of mitigation measures that may be feasible or effective over time. As a result, understanding shoreline composition provides important context for interpreting vulnerability patterns and identifying appropriate resilience strategies. To characterize shoreline type adjacent to military installations, shoreline classifications were reviewed at a planning level. Shoreline type characterization is based on Environmental Sensitivity Index (ESI) shoreline data from the East Florida 2020 atlas, which was funded and managed by the State of Florida and developed in accordance with NOAA ESI guidelines.

Vegetated shorelines, primarily salt- and brackish-marsh with localized mangrove pockets, are the prevailing edge type along tidal creeks and back-barrier margins of the lower St. Johns River (FWC, 2020). These marshes act as a roughness layer that dissipates wind-wave and vessel-wake energy, trap suspended sediment and build limited elevation capital along low banks. Their resilience is closely tied to elevation and exposure: as water levels rise and inundation becomes more frequent, marsh edges can become increasingly stressed, and sustained wake or storm-driven energy can accelerate shoreline retreat or lead to loss of vegetation along the shoreline margin. Figure 2-4 displays the mapped salt- and brackish-marsh shorelines at Marine Corps Support Facility Blount Island, where the shoreline is vegetated, and at Naval Station Mayport, where marsh is present along the south/estuarine side.



Figure 2-4. Vegetated Shoreline Types Adjacent to Military Installations in Northeast Florida



Notes:

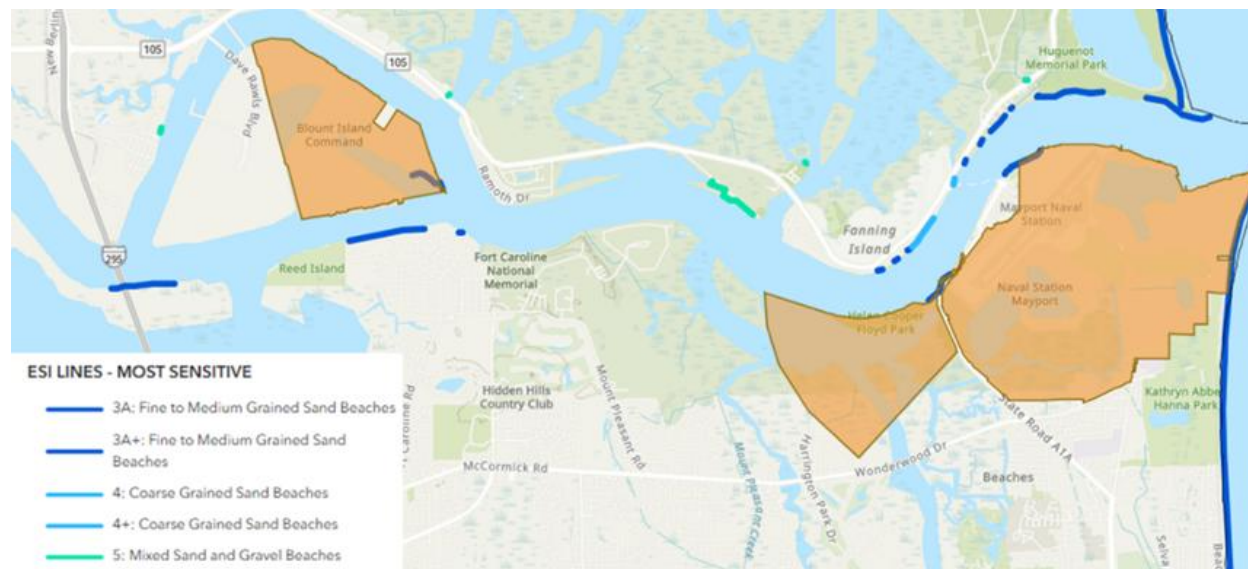
Based on ESI shoreline classifications.

Orange polygons indicate the locations of the Mayport Naval Station and Marine Corps Support Facility Blount Island.

Beaches and dunes occur primarily along the Atlantic frontage of Naval Station Mayport and the inlet-adjacent shorelines near the St. Johns River Entrance and Fort George Inlet, as mapped by ESI beach classes 3A–5; within the lower St. Johns estuary, sandy segments are limited and not a dominant shoreline type (FWC, 2020). On the open coast, these beaches and their backing dunes serve as important surge-buffering and public-access features, with condition closely tied to sediment supply and inlet dynamics around the St. Johns River Entrance; regional plans therefore emphasize periodic nourishment, coordinated sand bypassing, nearshore placement, and related sediment-management practices (FDEP, 2023; Hodgens et al., 2016). As shown in Figure 2-4, the beach/dune system functions as a key protective feature on the ocean-facing side of Naval Station Mayport, whereas beach frontage around Marine Corps Support Facility Blount Island is minimal (FWC, 2020).



Figure 2-5. Sandy Beach Shoreline Types Adjacent to Selected Military Installations in Northeast Florida



Notes:

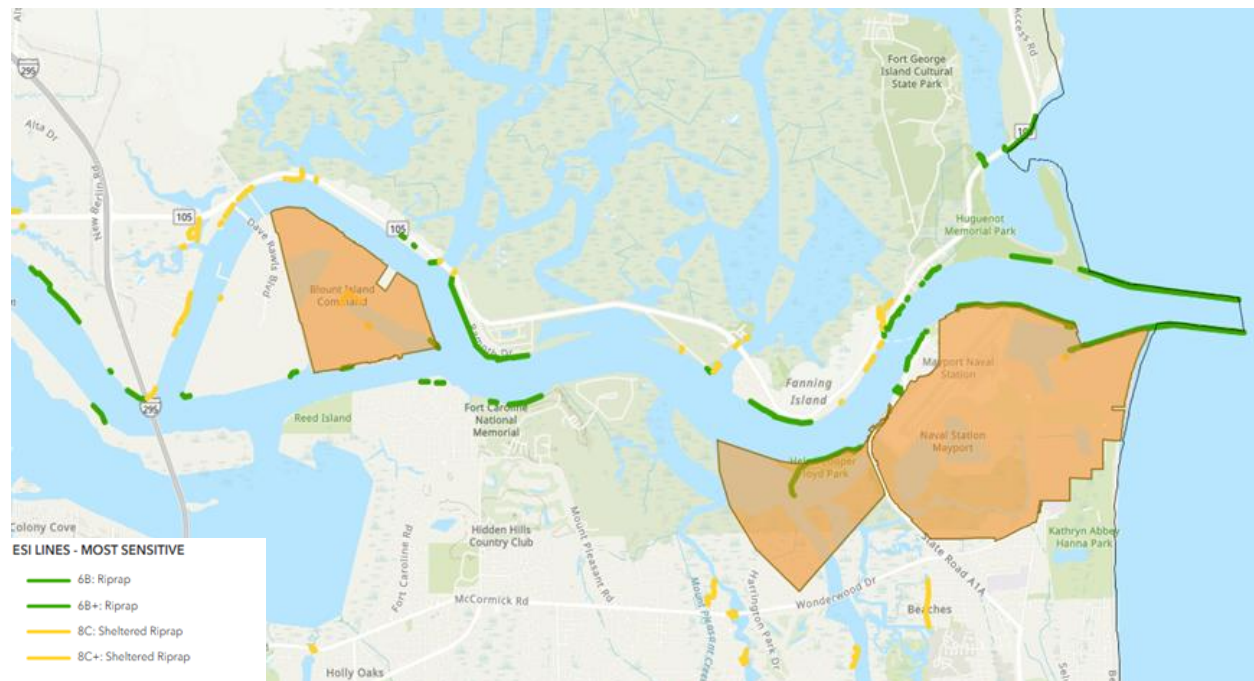
Based on ESI shoreline classifications.

Sandy shoreline is primarily limited to the ocean-facing frontage of Naval Station Mayport and is minimal or absent at inland tidal installations.

Orange polygons indicate the locations of Marine Corps Support Facility Blount Island and Naval Station Mayport.

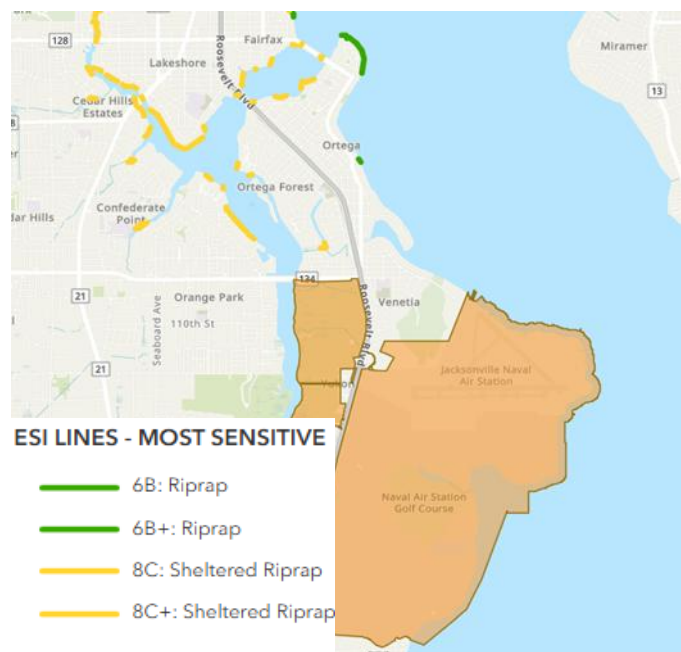
Engineered shorelines, principally riprap revetments and sheltered riprap (ESI 6B/6B+ and 8C/8C+), are concentrated along navigation corridors and developed riverfronts in the lower St. Johns, including the river- and inlet-facing margins of Naval Station Mayport and the berthing/turning-basin areas around Marine Corps Support Facility Blount Island (FWC, 2020). Figure 2-5 illustrates the spatial distribution of these engineered shoreline types; orange polygons denote the locations of the military installations. These sloped rock treatments are commonly used where fixed edge and operational access are required, providing toe protection and bank stability under moderate to high energy conditions. Design attention to toe stability and transition details helps manage the tendency for hard edges to reflect wave energy and cause localized bottom erosion at the base and ends of armored segments, especially where they meet natural marsh (Bilkovic et al., 2016).



Figure 2-6. Riprap Shoreline Types Based on ESI Shoreline Classifications**Notes:**

Orange polygons indicate the locations of Marine Corps Support Facility Blount Island and Naval Station Mayport.

Within interior tributaries near Naval Air Station Jacksonville, shown in Figure 2-7, armoring appears as shorter sheltered-riprap reaches along residential canals and road crossings, reflecting localized protection needs rather than continuous shoreline type (FWC, 2020). As water levels rise high water can persist longer, which places more pressure on armored shorelines and nearby banks; without careful detailing at the base and ends, those forces can loosen the armor or erode the bottom right next to it. In lower-energy locations, add-ons that combine small structural elements with vegetation or oysters can attenuate waves and wakes near the shore, maintain operational access, and improve long-term adaptability while providing habitat benefits (Bilkovic et al., 2016; Northeast Florida Regional Council & Resilient First Coast, 2024).

Figure 2-7. Distribution of Engineered Shoreline Types based on ESI Shoreline Classifications along Interior Tributaries Adjacent to Naval Air Station Jacksonville.

Taken together, shoreline types adjacent to military installations in Northeast Florida vary by location and reflect differing shoreline settings and management contexts. Marine Corps Support Facility Blount Island is bordered by vegetated

natural shoreline, consisting largely of salt and brackish marsh, with comparatively limited segments of riprap and minimal beach frontage. In contrast, Naval Station Mayport includes a greater extent of riprap along the river- and inlet-facing margins of the installation, together with sandy beach and dune frontage along the ocean-facing shoreline.

Shoreline types mapped near Naval Air Station Jacksonville occur primarily along interior tributaries of the lower St. Johns River and are represented by short, discontinuous reaches of sheltered riprap associated with residential canals and roadway crossings, rather than extensive or continuous shoreline armoring. Installations located farther inland, such as Camp Blanding Joint Training Facility and Outlying Landing Field Whitehouse, are outside the spatial extent of the ESI shoreline dataset and are therefore not reflected in the shoreline type mapping presented here. Overall, these patterns provide useful context for understanding how shoreline conditions differ among installations and how shoreline setting may influence vulnerability considerations and the range of shoreline management or mitigation approaches that may be relevant.

2.2.2 Erosion and Aging Infrastructure

Shoreline erosion in Northeast Florida occurs across oceanfront, inlet-adjacent, and inland tidal environments. Along the oceanfront beach, erosion is driven primarily by wave exposure, alongshore currents and storm events, while inland tidal and estuarine shorelines experience erosion through elevated water levels, tidal fluctuation, vessel traffic, and episodic storm surge (Northeast Florida Regional Council & Resilient First Coast, 2024; Dix et al., 2025).

Along the Atlantic shoreline of Duval County, erosion is a chronic and well-documented management concern. Statewide assessments identify approximately 10.4 miles of critically eroded beach and 0.7 miles of critically eroded inlet shoreline, with an additional two miles of inlet shoreline classified as eroding (FDEP, 2023; FDEP, 2024). These shorelines experience repeated hurricane impacts that drive episodic erosion and contribute to long-term shoreline retreat, requiring ongoing nourishment and stabilization efforts.

In inlet-adjacent settings, erosion is closely tied to altered sediment transport. At the St. Johns River Entrance and Fort George Inlet, jetties, channel stabilization, and maintenance dredging have modified littoral processes, resulting in localized erosion and increased reliance on sediment management and nourishment to maintain shoreline stability (Hodgens et al., 2016; FDEP, 2023). These engineered systems require continual intervention to offset sediment deficits created by navigation and inlet maintenance.

Moving inland, erosion along tidally influenced reaches of the St. Johns River is governed less by wave attack and more by elevated mean water levels, tidal range, and shoreline modification. This is particularly evident in Clay County, which lacks oceanfront shoreline but includes approximately 67 miles of tidally influenced river shoreline (Postal et al., 2010). In these settings, erosion typically manifests as riverbank instability, marsh edge retreat, and gradual loss of natural shoreline buffers. Rising mean high water levels are placing increasing stress on marsh platforms and vegetated shorelines that historically provided erosion control and flood attenuation (Northeast Florida Regional Council & Resilient First Coast, 2024). Vessel traffic further exacerbates these conditions, particularly along narrow creeks and developed estuarine corridors, where repeated wake energy accelerates marsh edge erosion and conversion to unvegetated intertidal areas (Dix et al., 2025).



Tidal river processes extend erosion-related vulnerability well inland. Tidal propagation, combined with navigational deepening, has altered hydrodynamics and salinity in the lower basin, increasing exposure of riverbanks and shoreline infrastructure to sustained high-water conditions (Postal et al., 2010). During extreme events, compound flooding can intensify these effects. Hurricane Irma demonstrated how elevated coastal water levels combined with rainfall-driven river discharge can produce prolonged high stages along the St. Johns River, increasing hydrostatic loading on bulkheads, revetments, and shoreline soils and contributing to erosion far inland of the open coast (Juárez et al., 2022).

A compounding factor across military installations is the age and design basis of existing shoreline protection infrastructure. Much of the armoring along installation shorelines including seawalls, bulkheads, revetments, and riprap was installed during earlier phases of base development, when design elevations reflected historical water levels and erosion conditions (Figure 2-8). As sea levels rise and tidal flooding becomes more frequent, these legacy structures are increasingly overtopped, undermined, or displaced, reducing their effectiveness and increasing maintenance demands.

Figure 2-8. Photos of Existing Rip-Rap and Armoring in Vicinity of Installations

Figure 2-8A. Riprap Protecting A1A along Narrow Shoreline near NAS Mayport



Figure 2-8B. Example of Derelict Armoring at Fanning Island



Figure 2-8C. Displaced Riprap along Mayport Shoreline



Figure 2-8D. Poorly Sorted, Aging Rip Rap along Mayport



2.3 Existing Mitigation Efforts

Efforts to mitigate shoreline erosion in Northeast Florida have developed through a combination of long-standing coastal management programs, navigation-related sediment practices, regulatory frameworks, and more recent exploration of nature-based approaches. Mitigation strategies vary by shoreline setting, reflecting differences between oceanfront and inlet-adjacent shorelines in Duval County and inland tidal and riverine shorelines along the St. Johns River system, including Clay County.

Existing shoreline mitigation across Northeast Florida military installations and adjacent infrastructure consists primarily of localized, hard-engineered measures intended to limit erosion, scour, and overtopping at critical assets rather than provide continuous shoreline protection (Figure 2-9). Riprap revetments are commonly installed along roadway corridors, marina shorelines, and developed waterfront edges to stabilize banks and reduce wave- and wake-induced erosion.

Figure 2-9. Photos of Existing Mitigation Efforts

Figure 2-9A. Riprap near NAS Mayport



Figure 2-9B. Riprap near NAS Jacksonville



Figure 2-9C. Berm with Riprap along Mayport Shoreline



Figure 2-9D. Blount Island Seawall



A armor stone has been placed selectively at locations subject to higher hydraulic stress, particularly near bridge abutments and piers, where scour potential is elevated during high-flow and surge conditions. At Blount Island, a combination of seawalls and hardened shoreline segments protects port and logistics facilities from tidal and vessel-related impacts.

In several locations, berms or low floodwalls located landward of riprap provide an additional line of defense by limiting overtopping and reducing the inland propagation of tidal flooding. Together, these measures reflect a piecemeal but strategic approach focused on protecting



high-value infrastructure and access points, while leaving substantial portions of shoreline in a natural or lightly stabilized condition.

Along the Atlantic coastline and major tidal inlets in Duval County, shoreline erosion mitigation has historically focused on beach nourishment, dune restoration, inlet sand bypassing, and coordinated sediment management linked to navigation maintenance (FDEP, 2023; FDEP, 2024; Hodgens et al., 2016). These approaches reflect a management objective of maintaining shoreline position in highly developed areas where erosion poses ongoing risks to infrastructure, recreation, and public access.

Regional Sediment Management (RSM) is a vital component of erosion mitigation along the Duval County coastline. Dredged material generated from Jacksonville Harbor and the St. Johns River entrance navigation projects has been repeatedly used to nourish downdrift beaches and nearshore areas where sediment compatibility allows, reducing reliance on offshore borrow sources and extending nourishment intervals (Hodgens et al., 2016). This practice also helps offset sediment deficits created by inlet stabilization structures and channel deepening associated with navigation improvements (FDEP, 2023).

Inlet-adjacent shorelines present additional management complexity due to altered littoral transport and inlet migration. At Fort George Inlet and Little Talbot Island, erosion has required a combination of shoreline armoring, relocation of vulnerable park facilities, and ongoing evaluation of inlet management alternatives under federal authorities (FDEP, 2023; FDEP, 2024). At the St. Johns River entrance, sediment management has been integrated into channel maintenance and deepening projects, with dredged material supporting both the Duval County Shore Protection Project and localized dune restoration efforts, including planned work at Naval Station Mayport (FDEP, 2023).

State-level regulatory and funding programs reinforce these sediment-based approaches. Florida's Beach and Shore Preservation Act, Coastal Construction Control Line regulations, and the Beach Erosion Control Program emphasize beach and dune restoration as preferred erosion mitigation tools while generally discouraging new hardened shoreline structures except where necessary to protect critical infrastructure (Postal et al., 2010; FDEP, 2023). Strategic Beach Management Plans provide the regional framework for coordinating nourishment, inlet sand transfer, and monitoring activities across Northeast Florida's Atlantic shoreline (FDEP, 2023).

Inland tidal and riverine shorelines are managed differently than open-coast beaches, relying on land-use controls, vegetated buffers, and setback requirements that preserve natural floodplain and shoreline functions and limit erosion (Postal et al., 2010; Crist et al., 2019). Conversely, conservation lands and less developed shorelines are generally managed to allow natural shoreline adjustment and wetland migration under rising water levels (Postal et al., 2010). Living shorelines incorporating marsh vegetation, oyster reefs, or low-profile sills are promoted as alternatives or supplements to hard armoring in lower-energy settings, particularly where vessel wakes and gradual water-level rise drive chronic erosion (Northeast Florida Regional Council & Resilient First Coast, 2024; Crist et al., 2019). Monitoring and restoration programs have demonstrated that oyster reefs and marsh plantings can significantly attenuate wave energy and stabilize eroding marsh edges, especially in estuarine and tidal creek settings common along the lower St. Johns River system (Dix et al., 2025).

Regional water management initiatives further reinforce this emphasis on nature-based shoreline mitigation. The St. Johns River Water Management District identifies living shorelines and other



green infrastructure as preferred resilience tools in its 2026–2030 Strategic Plan, citing their ability to provide long-term shoreline stabilization, flood attenuation, and ecological benefits with reduced maintenance demands. The District’s land acquisition and restoration programs similarly prioritize floodplain and coastal wetlands as non-structural flood- and erosion-mitigation assets, expanding natural shoreline buffers that support water storage and reduce exposure to rising water levels. Within the Lower St. Johns River Basin, the District leads and coordinates multi-agency efforts to restore estuarine shorelines, intertidal habitats, and coastal marshes in ways that explicitly account for sea level rise, reinforcing the role of wetland and marsh systems as integral components of shoreline resilience across Northeast Florida (SJRWMD, 2025)

In addition to broader regional planning efforts, site-specific mitigation initiatives are underway at select shoreline-adjacent military installations. At Marine Corps Support Facility Blount Island (Figure 2-10), a NOAA-supported collaborative effort has advanced planning and preliminary design for natural infrastructure projects intended to enhance shoreline and mission resilience. The initiative focuses on the beneficial reuse of dredged sediment to restore and elevate salt marsh areas, creating living shoreline features that attenuate wave energy, reduce erosion, and provide flood protection for critical waterfront infrastructure (NOAA, 2025b).

Figure 2-10. Living Shoreline along North Blount Island



Across both coastal and inland settings, shoreline erosion mitigation is supported by broader regional programs related to flood management, navigation, and ecosystem restoration. Water management district activities, floodplain restoration projects, and land conservation initiatives indirectly support shoreline stability by reducing erosive flows and maintaining natural buffers (Crist et al., 2019). Advances in understanding compound flooding dynamics in the St. Johns River estuary have also informed regional hazard assessment and planning, even where these insights have not yet translated into physical shoreline stabilization projects (Juárez et al., 2022).

Collectively, existing mitigation efforts in Northeast Florida reflect a context-specific and layered approach. Oceanfront and inlet-adjacent shorelines are managed through sustained sediment placement and structural interventions to address chronic erosion, while inland tidal and riverine shorelines are addressed through regulatory controls, drainage and floodplain management, and emerging nature-based stabilization strategies. These efforts establish the current mitigation baseline against which future shoreline erosion and inundation risks are evaluated.



3 Strategies for Shoreline Resilience

3.1 Adaptation Strategies

In Northeast Florida, addressing shoreline erosion involves a combination of sediment-based management, engineered stabilization, and nature-based solutions tailored to the region's diverse shoreline settings. Rather than relying on a single intervention, erosion mitigation strategies are applied along a continuum from high-energy oceanfront beaches to lower-energy inlet, estuarine, and tidal river environments. These approaches aim to protect critical infrastructure, maintain navigation access, and preserve the natural shoreline features that provide storm buffering and ecological function.

One of the most widely applied erosion mitigation approaches in Northeast Florida is beach nourishment. This strategy replenishes eroded shorelines with compatible sand sourced from offshore borrow areas or navigation dredging activities, providing immediate stabilization of beach and dune systems. Nourishment plays a significant role along the Atlantic coastline in Duval County, where repeated storm impacts and inlet-related sediment disruption have led to chronic erosion. While nourishment is effective at maintaining shoreline position and reducing near-term erosion risk, it requires ongoing maintenance to offset continued sand losses and respond to major storm events (FDEP, 2023; Hodgens et al., 2016).

Sediment management practices complement nourishment by restoring disrupted sediment transport pathways and improving the efficiency of erosion mitigation efforts. In Northeast Florida, this includes inlet sand bypassing, nearshore placement of dredged material, and beneficial use of sediment from navigation channel maintenance. These approaches are intended to retain sand within the littoral system, reduce downdrift erosion associated with inlet structures, and extend nourishment intervals over time (Hodgens et al., 2016). Sediment management is particularly important at the St. Johns River Entrance, where navigation and shoreline stability are linked (FDEP, 2023).

Engineered stabilization measures, such as seawalls, revetments, and groins, are used selectively to protect critical infrastructure, navigation features, and constrained shorelines. These structures can be effective at reducing localized erosion and safeguarding assets; however, they may alter sediment dynamics and increase erosion on adjacent shorelines if not carefully designed and managed. As a result, their application in Northeast Florida is generally limited to site-specific needs, such as inlet stabilization or infrastructure protection, rather than broad shoreline treatment (FDEP, 2023; Postal, Joiner, & Lilly, 2010).

Nature-based solutions are increasingly recognized as viable and sustainable erosion mitigation options, particularly in lower-energy coastal and inland tidal settings. Dune restoration using native vegetation is commonly employed along oceanfront shorelines to reinforce natural storm buffers and reduce erosion while providing habitat benefits. In estuarine and riverine environments, living shorelines, including marsh plantings, oyster reefs, and hybrid designs incorporating low-profile sills, are used to stabilize eroding banks, attenuate wave energy, and maintain ecological connectivity (Crist et al., 2019; Dix et al., 2025; Bilkovic et al., 2016). These approaches are especially relevant where erosion is driven by elevated water levels, vessel wakes, and gradual shoreline retreat rather than direct wave attack.



Monitoring and data-driven planning support the effective application of erosion mitigation measures. Shoreline mapping, sediment budget analyses, and post-project monitoring are used to track erosion trends, assess project performance, and inform adaptive management. Regional assessments emphasize the importance of continued monitoring to refine sediment placement strategies, evaluate nature-based solutions, and ensure that mitigation efforts remain effective under changing sea level and storm conditions (Hodgens et al., 2016; Dix et al., 2025).

3.2 Potential Coastal Hazard Mitigation Projects

In Northeast Florida, the applicability of erosion mitigation measures varies by shoreline setting, exposure to wave and tidal processes, and existing management context. Along the Atlantic coastline and inlet-adjacent shorelines in Duval County, erosion mitigation has historically emphasized sediment-based approaches, and similar strategies may continue to be considered where wide beaches and dune systems provide primary protection for adjacent infrastructure. Beach nourishment and dune restoration can help maintain shoreline position and buffering capacity, particularly in developed areas, but their long-term effectiveness remains closely tied to sediment availability, renourishment frequency, and ongoing funding support (FDEP, 2023; Hodgens et al., 2016).

Along the St. Johns River system and other tidally influenced shorelines, erosion and flooding drivers differ from open-coast settings and are more commonly linked to sustained water-level elevation, vessel wakes, and compound flooding rather than direct wave attack. In these environments, nature-based and hybrid approaches can offer flexible options for erosion control and flood-risk reduction where site-specific conditions support feasibility. The Resilient Jacksonville Vulnerability Assessment notes that the extent of non-hardened shoreline in Northeast Florida creates opportunities to implement these measures at broader scale, particularly along the St. Johns River and its tributaries. Examples include living shorelines, marsh restoration (including thin-layer sediment placement), riparian and floodplain restoration, and conservation of undeveloped shoreline (Fernleaf and The Water Institute, 2023).

In inlet-influenced settings, mitigation measures may need to account for the interaction between natural coastal processes and navigation infrastructure. Sediment management strategies that coordinate channel maintenance with downdrift beach support may help offset erosional effects associated with jetties and stabilized channels, while localized shoreline or dune restoration may provide additional protection where erosion threatens access, utilities, or mission-related assets (FDEP, 2023).

Based on the shoreline vulnerability review, a set of targeted adaptation strategies are recommended for consideration to reduce flood risk at locations where overtopping and inland inundation are most likely to initiate.

- At Naval Station Mayport, priority actions focus on interrupting key tidal flooding flow paths and protecting mission-critical infrastructure. Installation of a tide gate or flood barrier along the canal adjacent to Perimeter Road would limit tidal backflow that currently provides a primary pathway for inland flooding. By mid-century, additional measures will be needed to restrict flow beneath Mayport Road, such as raised roadway sections or controlled drainage structures, to prevent flooding from expanding into interior areas.



- To protect aviation operations, construction of a low stem wall or perimeter flood barrier around the airfield support area should be evaluated and phased in coordination with future airfield rehabilitation projects.
- In lower-lying areas south of Access Road, long-term feasibility may favor relocation or repurposing of vulnerable facilities, rather than attempting to maintain dry conditions indefinitely.
- Shoreline hardening along Massey Avenue and Macon Street should be elevated or retrofitted where existing armoring is overtopped, and planning should begin for future elevation of the south inlet jetty by late-century conditions to maintain inlet stability.
- Because shoreline ownership is shared, coordination with the City of Jacksonville is recommended for adaptation measures adjacent to the airfield, while federally owned shoreline along A1A should be addressed through coordinated federal planning and funding.

At Blount Island Command, adaptation measures should be integrated into asset replacement and recapitalization cycles. Elevating the northwest armored shoreline and lower dock elevations during scheduled replacement will improve resilience while minimizing lifecycle costs. Installation of a tide gate or backflow control structure along the central canal would address a dominant inundation pathway that governs interior flooding on the island. In the far term, bridge access to Blount Island may require elevation or clearance improvements to maintain reliable access under higher water levels; early engineering evaluation is recommended to inform long-range capital planning.

For Naval Air Station Jacksonville and associated access corridors, adaptation should focus on protecting critical transportation and shoreline-adjacent infrastructure. Increased scour risk at the Roosevelt Boulevard bridge warrants targeted shoreline stabilization and structural protection to preserve reliable access to the installation. Along the installation perimeter, overtopping of the southeastern seawall should be reduced through elevation or retrofit, potentially supplemented by landward barriers and drainage controls. Stabilization of the marina shoreline along Bluff Road through upgraded riprap or hybrid shoreline treatments would reduce erosion and protect adjacent infrastructure.

Collectively, these recommendations support a phased, systems-based adaptation strategy that prioritizes discrete flow paths, shoreline segments, and access points that control the extent of inland flooding. Near-term actions should focus on backflow prevention and protection of critical assets, while mid- and long-term measures align with recapitalization, relocation, and major infrastructure upgrades. This targeted approach maximizes resilience benefits while avoiding the cost and environmental impacts of continuous shoreline armoring.

3.3 Planning and Policy Approaches

Addressing vulnerabilities related to shoreline erosion in Northeast Florida requires a comprehensive approach that includes policy review, regional coordination, and consideration of both structural and nature-based shoreline management strategies. Integrating approaches such as beach nourishment, dune restoration, sediment management, and living shorelines can support shoreline stability while also providing ecological benefits. Collaborative efforts among local governments, regional planning entities, state agencies, and federal partners can help create coordinated management strategies that balance operational needs, environmental considerations, and long-term resilience objectives. By drawing on scientific data, engaging stakeholders, and



incorporating adaptive planning principles, a comprehensive framework can be developed to support shoreline protection adjacent to military installations and other critical infrastructure across the region. These planning and policy approaches are reinforced by regional water management frameworks that guide floodplain preservation, coastal wetland restoration, and living shoreline implementation across tidally influenced systems of the Lower St. Johns River Basin, providing a consistent basin-scale context for shoreline erosion and flood-risk management in Northeast Florida (SJRWMD, 2025).

As sea level rise models are updated and coastal risk is reassessed, existing state and local coastal management policies in Northeast Florida emphasize maintaining protective shoreline features and supporting restoration-based approaches where feasible. These policy directions provide an opportunity for military installations to integrate shoreline protection objectives with broader environmental and resilience goals, leveraging natural systems and sediment-based strategies to reduce long-term exposure to erosion-related risks (Postal et al., 2010; FDEP, 2023).

To effectively address these challenges, several key policy and planning considerations may be relevant:

1. **Integration with Regional Plans:** Ensuring that military and municipal shoreline management goals align is important for creating a consistent approach to erosion mitigation. Incorporating shoreline erosion considerations into hazard mitigation plans, comprehensive plans, and regional resiliency initiatives can help establish a long-term vision for shoreline protection across Northeast Florida.
2. **Regulatory Framework:** Compliance with federal, state, and local regulations, such as those set by **FEMA** and **FDEP**, is essential for the success of mitigation projects. There are opportunities to streamline permitting processes, which would help expedite the implementation of effective erosion mitigation strategies while maintaining regulatory compliance.
3. **Stakeholder Collaboration:** Partnerships among military installations, local governments, regional organizations, and environmental stakeholders are central to addressing shoreline erosion challenges. By working collaboratively, these entities can share technical information, coordinate project development, and align priorities across jurisdictions. Public outreach and engagement are crucial to support broader understanding of shoreline erosion processes and foster community support for shoreline management strategies.

Through a coordinated and adaptive planning approach, Northeast Florida can continue to develop a policy framework that supports shoreline erosion management while protecting critical infrastructure, sustaining military readiness, and preserving the natural systems that contribute to regional resilience.



4 Conclusion

This assessment demonstrates that shoreline vulnerability at Northeast Florida military installations is **not driven by uniform exposure, but by discrete low-elevation shoreline segments, canals, road crossings, and access corridors** that control the initiation and inland propagation of tidal inundation. Across Naval Station Mayport, Blount Island, and Naval Air Station Jacksonville, inundation consistently begins where shoreline elevations fall below projected tidal thresholds and where hydraulic connectivity allows water to move inland through drainage networks or transportation infrastructure. As sea levels rise, these failure points are expected to be exceeded more frequently, increasing both the extent and duration of flooding and placing growing strain on mission-critical infrastructure.

Applying a tiered prioritization framework clarifies where adaptation actions provide the greatest operational benefit. Tier 1 priorities include flow paths and shoreline segments whose failure would directly impair access, utilities, airfield operations, waterfront maintenance, or emergency response.

- At Naval Station Mayport, these include the canal along Perimeter Road, flow beneath Mayport Road, shoreline segments protecting facilities north of Access Road, and protection of airfield-support areas.
- At Blount Island, Tier 1 priorities include the northwest armored shoreline, lower dock elevations, and the central canal that governs interior flooding.
- For Naval Air Station Jacksonville, Tier 1 and Tier 2 priorities focus on access reliability and localized shoreline protection, including scour risk at the Roosevelt Boulevard bridge and overtopping along the southeastern seawall.

Tier 2 priorities include shoreline segments where impacts are significant but operational redundancy exists, such as armored shorelines along Massey Avenue and Macon Street or marina-adjacent shorelines along Bluff Road.

Tier 3 priorities include longer-term considerations such as elevation of the south inlet jetty at Mayport and potential bridge elevation to Blount Island that should be incorporated into long-range capital and transportation planning.

These findings support a targeted, systems-based adaptation strategy rather than continuous shoreline armoring. Focusing on discrete failure points allows installations to reduce flood risk efficiently, minimize environmental impacts to wetlands and estuarine systems, and align investments with asset life-cycle replacement and funding constraints. Importantly, the analysis also highlights that implementation feasibility is shaped by governance as much as engineering. Shoreline ownership is shared among federal entities, the City of Jacksonville, and regional agencies, and adaptation success will depend on coordinated planning, defined roles, and early agreement on cost-sharing and long-term maintenance responsibilities.

To translate these findings into action, the following next steps are recommended:

1. Advance Tier 1 projects to concept-level design, including tide gates, flow-path barriers, targeted shoreline elevation, and airfield protection measures, to support inclusion in near-term capital programming and MILCON planning.



2. Integrate Tier 2 adaptations into asset replacement and maintenance cycles, particularly for docks, armored shorelines, seawalls, and marina infrastructure, to maximize resilience benefits while minimizing lifecycle costs.
3. Initiate long-range planning for Tier 3 vulnerabilities, including inlet infrastructure and bridge access, to ensure future transportation and navigation investments account for projected water levels.
4. Establish formal coordination mechanisms among installations, the City of Jacksonville, and regional partners to align shoreline adaptation corridors, leverage existing capital improvement programs, and avoid risk transfer across jurisdictional boundaries.
5. Refine site-specific analyses at priority locations to confirm elevations, drainage connectivity, scour potential, and operational thresholds, providing the technical basis for final design and permitting.

Together, these steps position shoreline adaptation as a phased, mission-focused investment that strengthens installation resilience while supporting broader regional flood mitigation and environmental stewardship objectives.



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